

REMARKS

In the office action mailed November 30, 2004, the Examiner:

- rejected claims 1, 5, 8-11, 14, 17, 20 and 21 under 35 U.S.C. 102(b) as being anticipated by Corisis (US 6,326,687 B1);
- rejected claims 2-4, 6, 7, 13, 15, 16, 18 and 19 under 35 U.S.C. 103(a) as being unpatentable over Corisis, as applied to claims 1, 5, 8-11, 14, 17, 20 and 21; and
- rejected claim 12 under 35 U.S.C. 103(a) as being unpatentable over Corisis, as applied to claims 1, 5, 8-11, 14, 17, 20 and 21, and further in view of Solbrekken et al. (US 6,523,608 B1).

With this amendment, the pending claims are claims 1-21.

Claim Amendments

In this response, Applicant has amended independent claims 1, 13, 14 and 21 to recite that the conductive sheet provides at least one return current path from the die through the inner and outer regions of the conductive sheet to the ground lead finger. Support for these amendments is found in paragraphs 0028 and 0029 in conjunction with Fig. 3 of the present application. See, e.g., the dashed lines associated with the electrical current loops 375 and 376 that overlay different regions of the conductive sheet. No new matter has been added.

Claim Rejections – 35 U.S.C. 102(b)

Claim 1 as amended recites an electrical device package. The package includes a die, a plurality of lead fingers, a conductive sheet electrically connected to the die and at least one of the lead fingers and an encapsulant containing the die and the conductive sheet.

As shown in Fig. 3, the die is electrically connected to the interior of the conductive sheet and a ground lead finger 371 is electrically connected to a peripheral region of the conductive sheet while other lead fingers (372, 373) are insulated from the conductive sheet to avoid short circuit. With this arrangement, a return current path from the die to the ground lead finger is formed in the conductive sheet for each electrical current loop (375, 376), reducing the crosstalk noise between adjacent lead fingers (372, 373).

In addition, there is at least one opening in the conductive sheet, e.g., the through holes 341 in Fig. 3, allows the encapsulant to flow through the conductive sheet and form into one body on both sides of the conductive sheet, with little impact on the return current paths in the conductive sheet. Such an arrangement can effectively prevent the encapsulant from being detached from the conductive sheet during the packaging process.

In contrast, Corisis discloses a sandwich-like structure in which two heat spreaders 20,22 enclose a die 24 and encapsulant 12. As the Examiner concedes, Corisis does not explicitly disclose that the heat spreaders 20, 22 include an inner region that is electrically connected to die 24 at all. The Examiner's arguments to offset this deficiency in the Corisis patent can be summarized as follows:

- the heat spreader is electrically connected to the ground bus;
- the lead fingers are electrically connected to the die; and
- therefore the die is electrically connected to the inner region of the heat spreader.

This, however, overlooks Applicant's use of the conductive sheet as part of a circuit between the die and the lead finger(s) to which the conductive sheet is electrically connected.

The heat spreaders (20,22) in the Corisis patent serve only as ground planes for the device 10 since they are electrically grounded through their connections to the ground bus lead. Therefore, at most, these heat spreaders are equivalent to the prior art ground plane 291 in Fig. 2 of the present application. Of particular note, there is no return current path in the ground plane 291 since the die 210 is not connected to any part of the ground plane. Similarly, there is no return current path in the heat spreaders (20, 22) of Corisis. Without a return current path formed in any heat spreader, an electrical device package according to the Corisis patent cannot reduce the crosstalk caused by mutual inductance between two adjacent conductive lines.

Nor are the semicircular cutouts 70 in the sides of the heat spreaders the same as or equivalent to the openings in the conductive sheet in the present application. The cutouts are used for aligning the two heat spreaders 20, 22 with cutouts 76 in the encapsulation material 12, 84 (Corisis, col. 5, lines 18-27). Without any openings in the heat spreaders 20, 22, the encapsulant layers on the two sides of any heat spreader are only connected to each other at the edges of the heat spreader. Moisture

accumulated on the surface of the heat spreaders may form a vaporous layer during packaging. If the pressure of the layer is high enough, it may detach the encapsulation material from the heat spreader.

In contrast, the opening in Applicant's invention is one or more holes in the conductive sheet through which encapsulant can flow together. As a result, the conductive sheet has far less surface area for moisture accumulation. Moreover, besides the edges of the conductive sheet, the encapsulant layers on the two sides of the conductive sheet are connected to each other through the multiple openings in the conductive sheet, which provides a far more reliable protection for the die therein.

Since Corisis does not teach or suggest each feature recited in claim 1, claim 1 and its dependent claims 5 and 8-11 are not anticipated by Corisis.

Amended Claims 14 and 21 are independent claims that recite substantially a similar set of features as recited in claim 1 and have been rejected for essentially the same reasons as claim 1 was rejected. Claims 14, 17, 20 and 21 are not anticipated by Corisis for the same reasons claim 1 is not anticipated by Corisis.

Claim Rejections – 35 U.S.C. 103(a)

As mentioned above, Corisis does not teach or suggest all features recited in claims 1 and 14, respectively. For example, the heat spreaders (20, 22) are not electrically connected to any lead finger in the Corisis patent. Nor is there any opening in the heat spreaders (20, 22) allowing encapsulant to flow through to form into one body. Since claims 2-4, 6, 7, 15, 16, 18 and 19 are respectively dependant from claims 1 and 14, and claim 13 also recites these two distinguishing features, they are all patentable over Corisis for at least the same reasons mentioned above.

In addition to the two distinguishing features inherited from claim 1, claim 12 recites that the conductive sheet is a mesh made of copper. As shown in Fig. 3 of the present application, a mesh-like conductive sheet has many openings or through holes for encapsulant to flow through to prevent the encapsulant from detaching from the conductive sheet during the packaging process.

In contrast, as shown in Figs. 2 and 3 of Solbrekken, the grid frame 102 is pre-coated with a thermally conductive material, e.g., a solder material, and then placed between the heat dissipation plate 158 and the microelectronic die 112 during the packaging process. In other words, the grid frame 102 is a solid body, no longer like a mesh with many openings, when it is being packaged into the assembly 110. It is

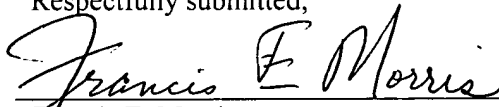
impossible for the encapsulant material to flow through the grid frame 102 during the packaging process. Therefore, the grid frame 102 in the Solbrekken patent is not equivalent to the mesh-like conductive sheet in Fig. 3 of the present application.

Additionally, the grid frame 102 attempts to solve a thermal issue related to the assembly 110 by dissipating heat produced by the die 112, while the present application tries to reduce crosstalk noise caused by mutual inductance between adjacent conductive lines, which is an electrical problem. These are two issues in two distinct fields of physics, thermal dissipation versus inductance screening, and require significantly different expertise. It is therefore neither obvious nor suggestive for anyone skilled in the art to come up with the mesh-like conductive sheet through the combination of the two patents. Accordingly, claim 12 is patentable over Corisis and further in view of Solbrekken.

In view of the forgoing remarks, the claims in this application are believed to be in condition for allowance. Such action is respectfully requested. If the Examiner believes a telephone interview would expedite prosecution of this application, he is invited to call applicants' attorney at the number given below.

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Respectfully submitted,


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